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some of the mixed excitations of these assumed nerves of smell must be outside of our experience, and consequently the corresponding sensations do not exist, and they would probably be found wanting even if by any artificial means the mixed excitement in question could be produced. Considering the discreteness of the chemical properties of compounds, it seems questionable whether a number of specific end organs could, by each responding more or less to the action of different compounds, give mixed excitements characteristic of these compounds.

Hence it seems that the sensations of smell must form a discrete manifoldness in any case, and it seems also that there must be a large number of specific groups of olfactory nerves, each corresponding to a characteristic odor forming an element of the above manifoldness, though probably each characteristic odor may be the nucleus of a limited region of continuity.

The existence of a large number of specific nerve groups is not without example among the several senses. For the auditory apparatus comprehends as many as sixteen to twenty thousand specific elements, each with an end organ adapted to the disturbing influence of a particular case of external stimulus. However, in any case the arrangement of a large number of specific end organs so as to prevent confusion is a difficult problem (remembering that the strongest argument in a case like the present is to show the possibility). Histology, indeed, recognizes but one type of end organ in the *regio olfactoria*, but we must remember that the character of the external stimuli active in the sense of smell requires the distinctive feature of these end organs to depend upon molecular structure, so that the microscope cannot distinguish between them. On the other hand, the character of the external stimuli of sound requires form to be the distinctive feature of the specific end organs of hearing. The present usefulness of the sense of smell to man scarcely seems to warrant the existence of a highly-organized apparatus of smell, yet there can be no doubt but that there may have been a period in our development when this sense was vastly more important. Indeed, there are indications of the degeneration of this sense in man.

All the experimental results in this field, although perfectly powerless in the direction in which the investigators have attempted to apply them, viz., toward the establishment of a systematic arrangement of odors, are cumulative evidence of the discontinuous nature of the sensations of smell, and of the existence of a large number of independent (nearly) groups of specific olfactory nerves.

Then, too, the fact that contrast effects are not known in odors as they are in colors, and the fact that fatigue for one odor leaves the sense delicate for another, both partake of the nature of positive evidence in this direction. If the large amount of patient and careful research in this field had been applied as evidence of this view of the subject, it might not have been so entirely fruitless, although it is difficult to see how positive evidence in this direction is to be reached, at least until histology is able to attack molecular structure, and chemistry has cleared away the mist still hanging over the nature of the "odorous particles."

NOTES ON MAGNETIC DECLINATION IN KANSAS.

BY PROF. F. O. MARVIN, STATE UNIVERSITY, LAWRENCE.

By Kansas law, each county surveyor in the State is required to observe the declination of the magnetic needle four times in each year — in the months of January, April, July, and October — and to report the results to the office of the Secretary of State and to the Chancellor of the University. No compensation is fixed for the performance of this duty, nor is any penalty attached for a non-compliance with the law. The law is therefore inoperative in most cases. There are on an average but fifteen to twenty county surveyors in the State each year that pay any attention to the matter. A record of such observations as have been made has been kept at the University for the last ten years. During this time fifty-seven of the one hundred and six counties of the State have made reports, some of these reporting every year, though the majority have reported in but one or two years out of the ten. The surveyors of Ness, Hodgeman, Edwards, Stafford, Rooks, Osborne, Russell, Ellsworth, Clay, Saline, Greenwood, Leavenworth and Miami counties are credited with the largest number of observations.

Some of the reports bear evidence on their face as to the poor quality of the observations. In a few cases a surveyor has reported over one and a half degrees difference between the quarterly observations of the same year. The same county has furnished observations in succeeding years that differ by a degree and a half, the latest observation being the larger. The apparent discrepancies can be accounted for in several ways: the surveyor may be the wrong man for the place, or he may be inexperienced; the reports may be made up through guess-work without any observations on a carefully-laid-out meridian; observations may be taken at different points in the county, and may be affected by local attraction; one surveyor may use a different instrument from the one used by his predecessor. It is a difficult matter then to take these reports, to compare them, to give more weight to some than to others, to reject some as unworthy of confidence, and to deduce an estimate of the rate of change and to construct an isogonic chart for the State. But I have attempted to do this, hoping that in the future a larger number of yearly reports may reach the University, and so forming a better basis for comparison.

The declination of the needle ranges from about 8°30′ in the southeast corner of the State to 12°30′ in the northwest corner. The isogonic lines in general trend a little to the west of south. The 9°30′ line runs through the northwest corner of Brown county, the western part of Jackson and the center of Shawnee counties; then bending eastward crosses the western parts of Franklin and Anderson counties; then returns to its westward trend, crossing Woodson county at the southeast corner, Wilson county through its center, and Chautauqua county through its eastern part. The 10° line approximately cuts the following points, viz., Belleville, Concordia, Clay Center, Fort Riley, Council Grove, the west line of Lyon county, a point half-way between Eureka and El Dorado, and leaves the State with the Arkansas river. The 11° line cuts Mankato, Osborne, the west line of Russell and Barton counties, Larned, and crosses the Arkansas river a few miles east of Dodge City. The 12° line cuts the northwest corner of Norton county, the southeast corner of Decatur county, the east line of Thomas county, the center of Gove county, the northwest corner of Lane county, and passes near Scott City, Lakin, and Ulysses. The intermediate lines are approximately parallel to the lines described, except those lying between the 10° and 11° lines. Around Ellsworth there is a closed line of 10°, forming an elliptical figure with its longest axis in a direction 45° east of north, and which covers nearly all of Ellsworth county. Around this figure are closed lines of 10°30′, 10°45, and perhaps of 11°30′. If we were to follow the Kansas and Smoky Hill rivers across the State, we would find the declination about as follows, viz.: Lawrence, 9°5′; Topeka, 9°20′; Manhattan, 9°55′; Junction City, 10°10′; Abilene, 10°20′; Salina, 11°30′; then decreasing to 10° at Ellsworth; then increasing again to 10°50′ at Russell; Hays City, 11°20′; Wakeeney, 11°40′; Gove, 12°; Wallace, 12°25′.

The rate of change as nearly as I can estimate it is about three minutes each year, the East declination decreasing. At Phillipsburgh from 1865 to 1882, the total change was 51′, or 3′ per year. At Seneca the total change from 1855 to 1880 has been reported as 30′, or 1′10″ per year. At Lincoln Center, from 1874 to 1884, the change was 33′, or 3′18″ per year. Observations extending over shorter periods, when coupled with these, make me think that the rate is as above stated, 3′ per year.

In order to secure results that can be compared, there ought to be established at each county seat a *true* meridian, permanently marked. The lines should be laid out carefully by competent persons, and with better instruments than are usually found in the hands of surveyors. The State by an appropriation could well provide for the actual expenses of such work, and the University could furnish the instruments and the men to do it. Then each surveyor should receive from the county a just compensation for his labor in taking the quarterly observations, and these should be taken with more system than is now done. To call the attention of the surveyor to the present law is of no avail, as the University has proved by sending out yearly a table of "Pole Star Times" and asking for compliance with the law.

NOTE ON THE SECOND SETTING OF CEMENT.

BY B. J. DALTON AND F. O. MARVIN, LAWRENCE.

It is proposed to study the action of cements, which, after having set, have again been mixed up into mortar and allowed to permanently harden. Some masons claim that this second setting of the cement increases its strength. On looking up what has been written on the subject, we find that modern engineers in their specifications demand that mortar which has set shall not be used. Yet we have found no statement of reasons, nor any record of tests comparing the strength of samples of the same cement; some having set once and others twice. We shall at this time report progress only, as too small a number of briquetts have been broken so far to enable us to draw safe conclusions. A full description of methods and results is then reserved for a future report, merely noticing now that the indications are that, with the cements used, a second setting injures their strength.

A PRELIMINARY STUDY OF "HOT WINDS."

BY SERGT. T. B. JENNINGS,
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In the study of this phenomenon, the first question to decide is, what are "hot winds"? A careful search through all the meteorological works at my command fails to reveal any definition. Shall every warm wind that proves a destructive blast to vegetation be termed a "hot wind"? I use the term "proves" under protest, because there are other conditions the effects of which are sometimes ascribed to "that hot wind."

In 1866, my first year in Kansas, we had in the eastern part of the State some "hot winds." During that summer our prevailing wind for about 60 days was southwest, and in that time we had a hot wind of eight days' duration, each day the temperature in Franklin county rising to upwards of 100°, and not falling below 80° during the nights. On the fourth day a long-range thermometer was laid across two sticks about six inches above the ground, on a path where there was not even dead grass. Its mercurial column rapidly extended, until it finally reached the limits of the instrument, 140°, when, after enduring the confinement for a short period, it found escape by bursting the bulb, and ended the experiment. The time was